# Method and apparatus for forming two flanges on a metal sheet


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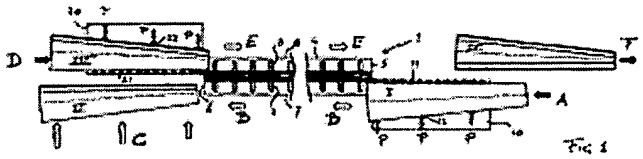
Abstract of **EP1138405**

The invention relates to a method for forming two opposite flanges on a metal sheet, in particular a tapered sheet, for building purposes using a rollformer (1), in which a first flange is formed at a first side (7) of the rollformer (1), and a second flange is formed at a second side (8) of the rollformer (1).
According to the invention, the metal sheet is moved from a front end (5) to a back end (6) of the rollformer (1) to provide the sheet with its first flange during its movement, and subsequently the metal sheet is moved from the back end (6) to the front end (5) of the rollformer (1) to provide the sheet with its second flange during its movement.
The invention also relates to a rollformer (1) with which it is possible to carry out the above method.

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## (54) Method and apparatus for forming two flanges on a metal sheet

(57) The invention relates to a method for forming two opposite flanges on a metal sheet, in particular a tapered sheet, for building purposes using a rollformer (1), in which a first flange is formed at a first side (7) of the rollformer (1), and a second flange is formed at a second side (8) of the rollformer (1).

According to the invention, the metal sheet is moved from a front end (5) to a back end (6) of the rollformer (1) to provide the sheet with its first flange during its movement, and subsequently the metal sheet is moved from the back end (6) to the front end (5) of the rollformer (1) to provide the sheet with its second flange during its movement.

The invention also relates to a rollformer (1) with which it is possible to carry out the above method.

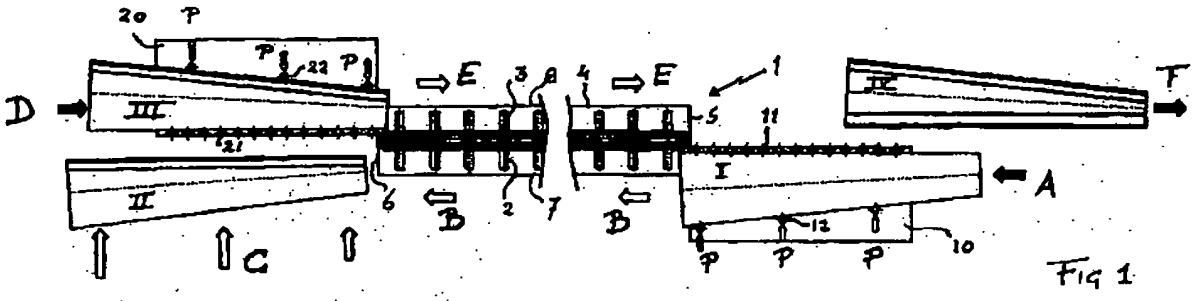


Fig 1

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## Description

[0001] The invention relates to a method for forming two opposite flanges on a metal sheet, in particular a tapered sheet, for building purposes using a rollformer, in which a first flange is formed at a first side of the rollformer, and a second flange is formed at a second side of the rollformer. The invention also relates to an apparatus for forming two opposite flanges on a metal sheet for building purposes.

[0002] Nowadays many buildings, and especially the roofs thereof, are constructed from metal panels. The longitudinal sides of the metal panels are bent upwards to form two opposite flanges, to form standing seams which are formed from one flange of one panel and the opposite flange of the neighbouring panel.

[0003] Most panels that are used for building purposes are straight, rectangular sheets, on which the flanges are formed with the use of a rollformer having rolls at both sides of the rollformer, with which both flanges are formed at the same time when the sheet passes through the rollformer.

[0004] However, modern buildings are often designed with more complex forms, such as conical forms. For such forms straight panels cannot be used, and tapered panels have to be made. To form the opposite flanges on a tapered sheet, it is not possible to use the conventional rollformer for straight sheets.

[0005] To form the flanges on a tapered sheet it is known to use the method from the preamble, using a rollformer having first forming rolls on one side and second forming rolls on the other side, and to form the first flange on the tapered sheet by moving the first side of the tapered sheet from beginning to end through the first forming rolls, to fetch back the panel, and to form the second flange on the tapered sheet by moving the second side of the tapered sheet from beginning to end through the second forming rolls.

[0006] In this way it is possible to form tapered sheets with two flanges, as is required, but this method is rather time-consuming.

[0007] It is an objective of the invention to provide a method for forming flanges on especially tapered metal panels that is faster in use than the present method, and that is easy to use.

[0008] It is another objective of the invention to provide an apparatus with which flanges can be formed on especially tapered metal sheets faster than it is possible with the known apparatus to form flanges on tapered metal sheets.

[0009] According to a first aspect of the invention, one of these objectives is reached with the method according to the preamble, in which the metal sheet is moved from a front end to a back end of the rollformer to provide the sheet with its first flange during its movement, and in that subsequently the metal sheet is moved from the back end to the front end of the rollformer to provide the sheet with its second flange during its movement.

[0010] Using this method it is no longer necessary to fetch back the metal sheet with the first flange to the front end of the rollformer. On its way back to the front end of the rollformer, the second flange is now directly made and the forming of the flanges is ready as soon as the sheet has passed all forming rolls of the rollformer. Since the transportation of the metal sheet from the back end to the front end of the rollformer is no longer needed, a considerable saving of time is reached by using the method according to the invention, taking in mind that a tapered sheet can be easily 20 meters or more in length.

[0011] According to a preferred method, between the forming of the first and the second flange the metal sheet with the first flange is moved sideways so as to be able to form the second flange on the second forming rolls of the rollformer.

[0012] Preferably at least during the entrance of the metal sheet into the rollformer the side that is provided with a flange is kept in line with the rollformer. In this way it is assured that the height of the flange formed is uniform over its length.

[0013] According to a second aspect of the invention there is provided an apparatus or rollformer for forming two opposite flanges on a metal sheet, in particular a tapered sheet, for building purposes, the apparatus having a front end, a back end, and two sides with successive forming rolls, in which first forming rolls on a first side of the apparatus are provided to form a first flange and second forming rolls on a second side of the apparatus are provided to form a second flange on the metal sheet, characterised in that the forming rolls on the first side of the apparatus have been provided to form the first flange starting at the front end of the apparatus, and the forming rolls on the second side of the apparatus have been provided to form the second flange starting at the back end of the apparatus.

[0014] This apparatus can be used for the method described above, to form the flanges on the metal sheet faster than with the known apparatus. The first forming rolls on the first side of the rollformer are arranged in the usual way to form the first flange gradually as the metal sheet moves through the rollformer from the front end to the back end. The second forming rolls, however, are arranged to form the second side of the metal sheet gradually as the metal sheet move from the back end to the front end through the rollformer. The sequence of the second rolls is thus reversed as compared to the conventional rollformer for tapered sheets. Though the rollformer is designed for tapered sheets, it is of course possible to form flanges on straight, rectangular sheets with it as well.

[0015] Preferably, the apparatus comprises a central, longitudinal frame having bearing shafts for the forming rolls that protrude at both sides of the frame, the bearing shafts protruding at the first side of the frame supporting the first forming rolls and the bearing shafts protruding at the second side of the frame supporting the second

forming rolls.

[0016] In this way, a slender rollformer is provided, with a longitudinal frame with driving components, and the protruding bearing shafts with the forming rolls at both sides of the frame. This construction also makes it possible to change the forming rolls quickly and easily when metal sheets with flanges with a different height are needed.

[0017] According to a preferred embodiment, the shafts are mounted in pairs vertically aligned, and all upper and/or all lower shafts are adjustable in height. To form flanges with a different height, at least all upper or all lower shafts should be adjustable in height, to provide the required intermediate distance between the shafts forming a pair.

[0018] Preferably a central gearbox is provided to synchronise all shafts.

[0019] According to a preferred embodiment, an entree table is provided at the front end of the apparatus to guide the metal sheet, preferably the entree table being provided with guiding means, for instance guiding rolls, and push means, for instance pneumatic cylinders, to force the metal sheet against the guiding means in line with the first forming rolls.

[0020] The entree table is placed at the front end of the rollformer to support the metal sheet before and during the forming of the first side of the metal sheet in the rollformer. To be able to move the metal sheet, the entree table will have bearing rolls or other movable supporting means. Since the first side of the metal sheet must be in line with the first forming rolls, preferably guiding means, such as rolls, are provided to guide the sheet. To force the sheet against the guiding rolls, push means are provided, which have to be movable since a tapered sheet varies in width.

[0021] Preferably a shift table is provided at the back end of the apparatus to guide the metal sheet during its movement from the first side to the second side of the apparatus, preferably the shift table being provided with guiding means, for instance guiding rolls, and push means, for instance pneumatic cylinders, to force the metal sheet against the guiding means in line with the second forming rolls.

[0022] This shift table serves the same purpose as the entree table, but than at the back end of the rollformer, to get the second side of the metal sheet in line with the second forming rolls. Moreover, the shift table is intended to provide for the sideways movement of the metal sheet after the first flange is formed, from the first side to the second side of the rollformer.

[0023] Preferably, the guiding means of the shift table are retractable under the surface of the shift table. In this way, the shift table can remain on its place, and while the guiding rolls are retracted the metal sheet can be pushed from the first side to the second side, after which the guiding rolls are replaced to guide the metal sheet. Alternatively, the guiding rolls are not retractable, but the shift table as a whole with the metal sheet on it is moved from the first to the second side of the rollformer.

[0024] The invention will be elucidated referring to an exemplary embodiment, in view of the accompanying drawing.

[0025] Fig. 1 shows the apparatus according to the invention schematically in top view, together with a tapered sheet in various production stages.

[0026] Fig. 2 shows the apparatus of fig. 1 in side view.

[0027] Fig. 1 shows a rollformer 1 according to the invention in top view, together with an entree table 10 and a shift table 20. Also, a tapered metal sheet with flanges is shown in four stadiums I, II, III, IV of the manufacturing process. Fig. 2 shows the rollformer 1 and the tables 10, 20 in side view.

[0028] Rollformer 1 has first bearing shafts 2 and second bearing shafts 3, supported by a frame 4 with a front end 5 and a back end 6, a first side 7 and a second side 8. The bearing shafts are mounted in pairs, for instance 2a, 2b, as shown in Fig. 2. On the bearing shafts 2, 3 forming rolls (not shown) are mounted. On each pair of first bearing shafts 2 a different pair of first forming rolls is mounted. The consecutive pairs of forming rolls from the front end 5 to the back end 6 of the rollformer 1 form a first side of a metal sheet from a flat state into a flange. In the same way, on each pair of second bearing shafts 3 a different pair of second forming rolls is mounted, which consecutively from the back end 6 to the front end 5 form a second side of a metal sheet from a flat state into a flange.

[0029] The entree table 10 is placed at the front end 5 of the rollformer 1 and has supporting means such as supporting rolls (not shown) for a metal sheet, and guide rolls 11 which are placed in line with the frame 4 of the rollformer 1, so a metal sheet will enter the rollformer 1 with its first side aligned with the forming rolls. In the entree table three push devices are mounted, of which the push rolls 12 are shown. These push rolls are connected to for instance pneumatic cylinders, which will continually push a metal sheet against the guide rolls, even when the width of the sheet changes, as is the case with tapered sheets.

[0030] The same applies mutatis mutandis for the shift table 20, having guide rolls 21 and push rolls 22. However, the shift table 20 also has to accommodate the sideways movement of the metal sheet from the first side 7 to the second side 8 of the rollformer 1. For this, it is possible to move the shift table 20 as a whole. Alternatively, it is possible to move the metal sheet over the shift table 20 while the shift table itself remains on its place. To be able to do so, the guide rolls 21 have to be retractable under the surface of the table, so as not to hinder the movement of the sheet from the first side 7 to the second side 8 of the rollformer.

[0031] The forming of a metal sheet with two opposing flanges will be elucidated hereinafter.

[0032] In Fig. 1, a tapered metal sheet is shown in its forming stadium I, in which the sheet is still flat. It is

placed on the entree table 10 and is pushed with its first side against the guide rolls 11 by the push rolls 12.

[0033] The metal sheet is than moved in direction A into the rollformer 1 and through the rollformer in the direction B. During the movement of the sheet over the entree table 10, the push rolls 12 move in the direction P towards the guide rolls 11, since the width of the tapered sheet diminishes towards the end of the sheet.

[0034] As the sheet is moved through the rollformer 1, the first forming rolls on the first side 7 of the rollformer 1 sequentially form a first flange on the metal sheet.

[0035] After the sheet has left the first side of the rollformer 1, the metal sheet is in its stadium II, in which it possesses the first flange on its first side.

[0036] The metal sheet is than moved sideways in direction C on shift table 20, until it is at the second side 8 of the rollformer 1. There the sheet is pushed against the guide rolls 21 by the push rolls 22. This is stadium III of the metal sheet.

[0037] Subsequently, the metal sheet is moved in direction D into the rollformer 1 and through the rollformer in direction E. During the movement of the sheet over the shift table 20, the push rolls 22 move in direction P away from the guide rolls 21, since during this movement the width of the tapered sheet increases towards the end of the sheet.

[0038] As the sheet is moved through the rollformer 1, the second forming rolls on the second side 8 of the rollformer 1 sequentially form a second flange on the metal sheet.

[0039] When the sheet leaves the rollformer 1, it has reached its fourth and last stadium IV and can be carried off in direction F.

[0040] Though not shown, it will be clear that the rollformer according to the invention has moving means such as moving rolls to move a metal sheet through the rollformer and over the tables.

[0041] To be able to form metal sheets with a different flange height, for instance the upper bearing shafts are adjustable in vertical direction, so forming rolls with a different diameter can be used. All bearing shafts are synchronised using a central gear box.

[0042] It will be understood that, though the rollformer is designed to form flanges on tapered metal sheets, the rollformer can equally well be used to form flanges on straight, rectangular metal sheets. Also it will be understood that, though the forming in Fig. 1 is shown to start with the wide side of a tapered sheet, it is possible to start will the narrow side.

[0043] Moreover, it will be understood that modifications can be made in the design of the rollformer which do not change the concept of rollformer. It will for instance be possible to make a wide frame for the rollformer, and so have the bearing shafts mounted with their ends in both the left and the right side of the frame. In this way, the rollformer looks like a conventional rollformer for straight sheets in which the sheets have to move in between both sides of the rollformer, but now the forming rolls are mounted differently, and the metal sheet is now moved first alongside one side of the rollformer and than back alongside the other side of the rollformer.

## Claims

1. Method for forming two opposite flanges on a metal sheet, in particular a tapered sheet, for building purposes using a rollformer, in which a first flange is formed at a first side of the rollformer, and a second flange is formed at a second side of the rollformer, characterised in that the metal sheet is moved from a front end to a back end of the rollformer to provide the sheet with its first flange during its movement, and in that subsequently the metal sheet is moved from the back end to the front end of the rollformer to provide the sheet with its second flange during its movement.

2. Method according to claim 1, characterised in that between the forming of the first and the second flange the metal sheet with the first flange is moved sideways.

3. Method according to claim 1 or 2, characterised in that at least during the entrance of the metal sheet into the rollformer the side of the metal sheet that is provided with a flange is kept in line with the rollformer.

4. Apparatus or rollformer for forming two opposite flanges on a metal sheet for building purposes, in particular a tapered sheet, the apparatus having a front end, a back end, and two sides with successive forming rolls, in which first forming rolls on a first side of the apparatus have been provided to form a first flange and second forming rolls on a second side of the apparatus have been provided to form a second flange on the metal sheet, characterised in that the forming rolls on the first side of the apparatus have been provided to form the first flange starting at the front end of the apparatus, and the forming rolls on the second side of the apparatus have been provided to form the second flange starting at the back end of the apparatus.

5. Apparatus according to claim 4, characterised in that the apparatus comprises a central, longitudinal frame having bearing shafts for the forming rolls that protrude at both sides of the frame, the bearing shafts protruding at the first side of the frame supporting the first forming rolls and the bearing shafts protruding at the second side of the frame supporting the second forming rolls.

6. Apparatus according to claim 5, characterised in

that the shafts are mounted in pairs vertically aligned, and that all upper and/or all lower shafts are adjustable in height.

7. Apparatus according to claim 5 or 6, **characterised in that** a central gearbox is provided to synchronise all shafts.

8. Apparatus according to any one of the claims 4 - 7, **characterised in that** an entree table is provided at the front end of the apparatus to guide the metal sheet, preferably the entree table being provided with guiding means, for instance guiding rolls, and push means, for instance pneumatic cylinders, to force the metal sheet against the guiding means in line with the first forming rolls.

9. Apparatus according to any one of claims 4 - 8, **characterised in that** a shift table is provided at the back end of the apparatus to guide the metal sheet during its movement from the first side to the second side of the apparatus, preferably the shift table being provided with guiding means, for instance guiding rolls, and push means, for instance pneumatic cylinders, to force the metal sheet against the guiding means in line with the second forming rolls.

10. Apparatus according to claim 9, **characterised in that** the guiding means of the shift table are retractable under the surface of the shift table.

Fig 2

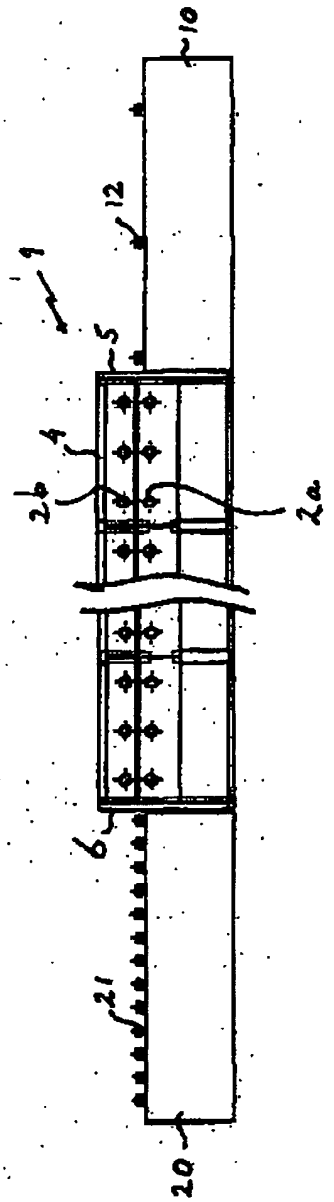
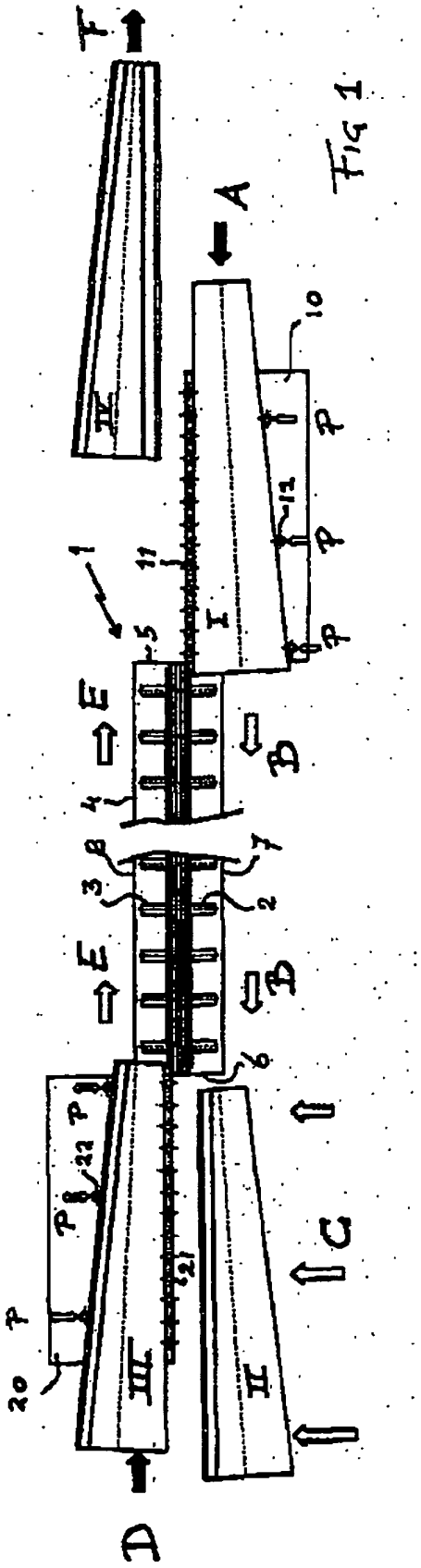



Fig 1



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# EUROPEAN SEARCH REPORT

Application Number
EP 00 20 1161

## DOCUMENTS CONSIDERED TO BE RELEVANT

| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.7) |
|---|---|---|---|
| A | DE 196 12 239 A (BACK RICHARD)<br>2 October 1997 (1997-10-02)<br>* figures 1-3 * | 1,4 | B21D19/04<br>B21D5/08 |
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TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B21D

The present search report has been drawn up for all claims

| Place of search | Date of completion of the search | Examiner |
|---|---|---|
| MUNICH | 28 August 2000 | Vinci, V |

CATEGORY OF CITED DOCUMENTS

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# ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 00 20 1161

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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